APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,789	01/02/2002	David K. Poulsen	INTL-0663-US (P12629)	9218

		EXAMINER
7590 06/14/2005		YIGDALL, MICHAEL J

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ART UNIT	PAPER NUMBER
2192	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/039,789	POULSEN ET AL.
	Examiner	Art Unit	
	Michael J. Yigdall	2192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>09 March 2005</u>.

2a) ☒ This action is **FINAL**.   2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-20* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-20* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   Applicant's amendment and response filed on March 9, 2005 has been fully considered.
Claims 1-20 are pending.

Response to Arguments

2.   Applicant's arguments have been fully considered but they are not persuasive.

        Applicant contends that neither Poulsen nor Sundaresan teaches or suggests translating a
program unit into two different program units (Applicant's remarks, page 5, third paragraph).

        However, the rejections are based on a combination of the references. As set forth in the
previous Office action, Poulsen discloses translating a program, a first program unit, into a
translated parallel computer program (see, for example, column 8, lines 32-35). The first
program unit includes parallel regions and global storage objects (see, for example, column 8,
lines 29-30). Sundaresan discloses an example of such parallel regions, namely a reduction
operation associated with a set of values or variables that is partitioned among a plurality of
threads (see, for example, column 7, lines 13-16) and that performs an algebraic operation on the
variables (see, for example, column 1, lines 59-63).

        Accordingly, Poulsen in view of Sundaresan teaches translating a first program unit to
partition a reduction operation among a plurality of threads, and translating a first program unit
to perform an algebraic operation on a set of variables. The translated parallel computer program
would thus include a set or some unit of instructions for partitioning the reduction operation, and
a set or some unit of instructions for performing the algebraic operation. The first set or unit of

instructions is a "second program unit," and the second set or unit of instructions is a "third

program unit," relative to the non-translated "first program unit."

Therefore, Poulsen in view of Sundaresan teaches translating a program unit into two

different program units. Moreover, Poulsen alone teaches this limitation. As noted above, the

first program unit includes parallel regions and global storage objects (see, for example, column

8, lines 32-35). Poulsen discloses two different translations. First, translating the global storage

objects by declaring privatizable storage objects (see, for example, column 8, lines 59-61), and

second, translating the parallel regions by translating references and inserting other instructions

(see, for example, column 9, lines 2-12). The translated storage objects are one unit of the

translated program, and the translated parallel regions are another unit of the translated program.

Thus, Poulsen teaches translating the first program unit into second and third program units.

Claim Rejections - 35 USC § 103

3.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

4.   Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No.

5,812,852 to Poulsen et al. (art of record, "Poulsen") in view of U.S. Pat. No. 5,937,194 to

Sundaresan (art of record, "Sundaresan").

With respect to claim 1 (original), Poulsen discloses a method comprising:

(a) receiving a first program unit in a parallel computing environment (see, for example,

column 8, lines 29-30, which shows receiving a first parallel computer program unit).

Although Poulsen discloses that the first program unit includes parallel regions and

global storage objects (see, for example, column 8, lines 29-30), Poulsen does not expressly

disclose the limitation wherein the first program unit includes a reduction operation associated

with a set of variables.

However, Sundaresan discloses a reduction operation associated with a set of values or

variables, wherein the reduction operation performs an algebraic operation on the values or

variables and is partitioned among a plurality of threads (see, for example, column 7, lines 13-16,

and column 1, lines 59-63). The reduction operation in Sundaresan is implemented with reusable

reduction objects so as to improve the expressibility and maintenance of parallel code (see, for

example, column 5, lines 7-14, 21-23 and 30-33).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to modify the system of Poulsen to include a reduction operation, such as with the

reusable reduction objects taught by Sundaresan, for the purpose of improving the expressibility

and maintenance of the parallel computer program.

Therefore, Poulsen in view of Sundaresan discloses receiving a first program unit in a

parallel computing environment, the first program unit including a reduction operation associated

with a set of variables.

Poulsen in view of Sundaresan further discloses:

(b) translating the first program unit into a second program unit, the second program unit

to associate the reduction operation with a set of one or more instructions operative to partition

the reduction operation between a plurality of threads including at least two threads (see, for example, Poulsen, column 8, lines 32-35, which shows translating the program, and Sundaresan, column 7, lines 13-16, which shows that the reduction operation is partitioned among a plurality of threads, as presented above); and

(c) translating the first program unit into a third program unit, the third program unit to associate the reduction operation with a set of one or more instructions operative to perform an algebraic operation on the variables (see, for example, Poulsen, column 8, lines 32-35, which shows translating the program, and Sundaresan, column 7, lines 13-16, and column 1, lines 59-63, which shows that the reduction operation performs an algebraic operation on the values or variables, as presented above).

The first program unit is thus translated to partition the reduction operation among a plurality of threads and to perform an algebraic operation on the variables. The set or unit of instructions operative to partition the reduction operation among the plurality of threads is a second program unit, and the set or unit of instructions operative to perform the algebraic operation on the variables is a third program unit.

With respect to claim 2 (original), Poulsen in view of Sundaresan further discloses encapsulating the reduction operation with the instructions associated with the third program unit (see, for example, Poulsen, column 8, lines 46-47 and 59-61, which shows encapsulating objects when translating the program).

With respect to claim 3 (original), Poulsen in view of Sundaresan further discloses

reducing the variables logarithmically (see, for example, Sundaresan, column 7, lines 16-18,

which shows that the reduction operation reduces the values or variables logarithmically).

With respect to claim 4 (original), Poulsen in view of Sundaresan further discloses

translating the first program unit into the second program unit utilizing, in part, a source-code to

source-code translator (see, for example, Poulsen, column 8, lines 35-37, which shows

translating the program with a source-to-source translator).

With respect to claim 5 (original), Poulsen in view of Sundaresan further discloses

translating the first program unit into the third program unit utilizing, in part, a source-code to

source-code translator (see, for example, Poulsen, column 8, lines 35-37, which shows

translating the program with a source-to-source translator).

With respect to claim 6 (original), Poulsen in view Sundaresan further discloses

associating the plurality of threads each with a unique portion of the set of variables (see, for

example, Sundaresan, column 7, lines 20-21, which shows that the reduction operation associates

individual values or variables to each of the threads).

With respect to claim 7 (original), Poulsen in view of Sundaresan further discloses

combining, in part, the variables associated with the plurality of threads in a pair-wise reduction

operation (see, for example, Sundaresan, column 11, line 48 to column 12, line 7, which shows a

sample reduction operation that combines the values or variables associated with the plurality of

threads in a pair-wise reduction operation, wherein a given thread has a fan-in of two threads, which is to say a pair of threads).

With respect to claim 8 (currently amended), Poulsen discloses an apparatus comprising:

(a) a memory including a shared memory location (see, for example, column 8, lines 37-39, which shows a memory, and column 7, lines 7-10, which shows a global storage object in a shared memory location);

(b) a translation unit coupled with the memory (see, for example, column 8, lines 32-35, which shows a translation means).

Although Poulsen discloses a first parallel computer program unit (see, for example, column 8, lines 29-30) and further discloses translating the first program unit (see, for example, column 8, lines 32-35), Poulsen does not expressly disclose the limitation wherein the translation unit is to translate a first program unit including a reduction operation associated with a set of at least two variables into a second program unit, the second program unit to associate the reduction operation with one or more instructions operative to partition the reduction operation between a plurality of threads including at least two threads, and wherein the translation unit is to also translate the first program unit into a third program unit, the third program unit to associate the reduction operation with a set of one or more instructions operative to perform an algebraic operation on the variables.

However, Sundaresan discloses a reduction operation associated with a set of values or variables, wherein the reduction operation performs an algebraic operation on the values or variables and is partitioned among a plurality of threads (see, for example, column 7, lines 13-16, and column 1, lines 59-63). The reduction operation in Sundaresan is implemented with reusable

reduction objects so as to improve the expressibility and maintenance of parallel code (see, for example, column 5, lines 7-14, 21-23 and 30-33).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Poulsen to include a reduction operation, such as with the reusable reduction objects taught by Sundaresan, for the purpose of improving the expressibility and maintenance of the parallel computer program.

Therefore, Poulsen in view of Sundaresan discloses a translation unit coupled with the memory, the translation unit to translate a first program unit including a reduction operation associated with a set of at least two variables into a second program unit, the second program unit to associate the reduction operation with one or more instructions operative to partition the reduction operation between a plurality of threads including at least two threads, the translation unit to also translate the first program unit into a third program unit, the third program unit to associate the reduction operation with a set of one or more instructions operative to perform an algebraic operation on the variables (see the rejection of claim 1 above).

Poulsen in view of Sundaresan further discloses:

(c) a compiler unit coupled with the translation unit and the memory, the compiler unit to compile the second program unit and the third program unit (see, for example, Poulsen, column 8, lines 42-45, which shows an executable program, which is to say a compiled program, and column 13, lines 11-13, which shows that the translation may be integrated with a compiler); and

(d) a linker unit coupled with the compiler unit and the memory, the linker unit to link the compiled second program unit and the compiled third program unit with a library (see, for

example, Poulsen, column 8, lines 39-42, which shows a linker for linking the program with a

library).

With respect to claim 9 (currently amended), Poulsen in view of Sundaresan further

discloses the limitation wherein the second program unit is to associate a set of one or more

instructions with the reduction operation to encapsulate the reduction operation (see, for

example, Poulsen, column 8, lines 46-47 and 59-61, which shows encapsulating objects when

translating the program).

With respect to claim 10 (original), Poulsen in view of Sundaresan further discloses the

limitation wherein the variables in the set of variables are each uniquely associated with the

plurality of threads and the library includes instructions operative to combine, in part, the

variables associated with the plurality of threads (see, for example, Poulsen, column 10, lines 9-

11 and 15-19, which shows that instructions in the library are called for each parallel region in

the program, and Sundaresan, column 7, lines 20-21, which shows that the reduction operation

associates individual values or variables to each of the threads).

With respect to claim 11 (original), Poulsen in view of Sundaresan further discloses the

limitation wherein the library includes instructions operative to combine, in part, the variables in

a pair-wise reduction (see, for example, Sundaresan, column 11, line 48 to column 12, line 7,

which shows a sample reduction operation that combines the values or variables associated with

the plurality of threads in a pair-wise reduction operation, wherein a given thread has a fan-in of

two threads, which is to say a pair of threads).

With respect to claim 12 (original), Poulsen in view of Sundaresan further discloses a set of one or more processors to host the plurality of threads, the plurality of threads to execute instructions associated with the second program unit (see, for example, Poulsen, column 6, lines 46-50, which shows one or more processors for executing the plurality of threads).

With respect to claim 13 (currently amended), Poulsen in view of Sundaresan further discloses the limitation wherein the second program unit includes a callback routine and the callback routine is associated with instructions operative to perform an algebraic operation on at least two variables in the set of variables (see, for example, Poulsen, column 9, line 63 to column 10, line 9, which shows callback routines for the parallel regions in the program, and Sundaresan, column 7, lines 13-16, and column 1, lines 59-63, which shows that the reduction operation performs an algebraic operation on the values or variables).

With respect to claim 14 (original), Poulsen in view of Sundaresan further discloses the apparatus of claim 13 wherein the library is operative to call the callback routine to perform, in part, a reduction on at least two variables in the set of variables (see, for example, Poulsen, column 10, lines 9-11 and 15-19, which shows that the routines in the library are called for each parallel region in the program, and Sundaresan, column 7, lines 13-16, which shows that the reduction operation performs a reduction on the values or variables).

With respect to claim 15 (original), the limitations recited in the claim are analogous to the limitations recited in claim 1 (see the rejection of claim 1 above). Poulsen in view of Sundaresan further discloses a machine-readable medium that provides instructions, that when

executed by a set of one or more processors, enable the set of processors to perform the recited

operations (see, for example, Poulsen, column 8, lines 37-39, and column 6, lines 46-50).

With respect to claim 16 (currently amended), see the rejection of claim 2 above.

With respect to claim 17 (currently amended), see the rejection of claim 4 above.

With respect to claim 18 (currently amended), see the rejection of claim 3 above.

With respect to claim 19 (currently amended), see the rejection of claim 5 above.

With respect to claim 20 (currently amended), see the rejection of claim 7 above.

Conclusion

5.   Applicant's amendment necessitated the new ground(s) of rejection presented in this

Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this

final action.

6.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Michael J. Yigdall whose telephone number is (571) 272-3707.

The examiner can normally be reached on Monday through Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax phone number for the

organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/MY/   Michael J. Yigdall
                        Examiner
                        Art Unit 2192

mjy

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SUPERVISORY PATENT EXAMINER